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ALTERING OF CERVICAL SAGITTAL PARAMETERS AFTER 1 OR 2 LEVELS ANTERIOR CERVICAL DISCECTOMY AND FUSION WITH LORDOTIC CAGES. SHORT TERM RESULTS.

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SUMMARY

Objective: To investigate changings of cervical sagittal parameters after anterior discectomy and fusion (ACDF) with lordosis cages.

Material and methods: This study includes 55 patients with one and two levels of soft cervical disc hernia who were operated via ACDF with lordosis cage. The study is designated retrospectively. Visual analog scale (VAS) values, cervical lordosis angle, cranial slope and C_2 tilt were evaluated preoperatively and postoperatively at some certain periods. Changings of these parameters compared statistically. Correlation between VAS values and sagittal parameters were investigated statistically.

Results: No statistically significant differences were found between preoperative and postoperative sagittal parameters. Statistical analysis showed that change of VAS values is significant for every level and two levels disk hernia for all postoperative follow-up times ($p<0.001$).

Conclusions: Restoration of cervical sagittal parameters measurements come closer those of normal population values after surgery. However, these changings were not statistically significant. The clinical results of surgical treatment of cervical disc disease generally come before radiological improvement like other areas of spinal surgery. It is expected that statistically significant results can be obtained from long term follow-ups since these parameters approaching the values of normal population in the early postoperative period.

Key words: Anterior cervical discectomy and fusion, cervical sagittal parameters, lordotic intervertebral cage

Level of Evidence: Retrospective clinical study, Level III

INTRODUCTION

It is widely accepted that cervical degenerative disc diseases (CDDD) occurs in some degenerative background. These degenerative cervical changes result in cervical sagittal malalignment [2,14,15]. This study emerges from the idea that after removing degenerative disc material surgically and decompressing the neural tissue, sagittal profile can be restored to the similar values those of normal population [12]. The secondary opinion of the study is to use lordosis cage for facilitating this restoration. A radiographic study designated from this point of view. Cervical sagittal alignment is commonly assessed by calculating cervical lordosis and some other related metrics that gives slope of the head or proximal thoracic region [11,15]. Because the cervical spine is the most mobile part of the spinal column, a wide range of normal alignment has been described [5]. Value and the center of cervical lordosis are the main basis of cervical sagittal alignment measurements [10].

The main aim of this study is to show whether radiographic sagittal restoration occurs or not after anterior cervical discectomy with fusion (ACDF) with a lordosis cage for CDDD. This study gives short-term results.

MATERIAL AND METHODS

After obtaining an approval from Düzce University Committee on Ethics for Non-interventional Health Studies (16 Jan, 2017-2017/01), retrospectively designated study began.

Study includes 55 patients who were performed ACDF with a lordosis cage in between 2015 and 2017 in Düzce University Hospital. Patients were between 18 and 70 years old men and women with one or two levels of soft cervical disc herniation's (CDH) that were performed ACDF after the failure of 3 weeks of medical treatment.

Including criteria

1. Men and women between 18 and 70 years old with 1 or 2 levels soft CDH that were performed ACDF after the failure of 3 weeks of medical treatment.
2. Patients who have symptoms were relevant to their radiological imaging studies were included in the study.
3. Excluding criteria
4. Patients who have cervical spondylosis, olisthesis, spondylotic myelopathy and foraminal bony narrowing;
5. Patients who were performed operation for cervical region for any reason;
6. Patients who have traumatic disc hernia or any traumatic condition affecting cervical region;
7. Patients who have cervical congenital anomalies or malformations such as Klippel Feil anomaly or Chiari malformation;
8. Patient who have severe metabolic diseases such as diabetes or chronic obstructive pulmonary diseases;
9. Patients who have malignant diseases, and already had chemotherapy or radiotherapy are excluded from the study.

All patients were performed detailed neurological examination and obtained visual analog scale (VAS) scores preoperatively, postoperatively on the 1st day, 15th day and the 3rd month.

Radiographic measurements

All patients were performed standing lateral cervical roentgenograms preoperatively, postoperatively on the 1st day, 15th day and the 3rd month. Sagittal parameters were measured on these roentgenograms. Cervical lordosis angle (CL) (Fig. 1), C_2 tilt angle (C_2T) (Fig. 2), and Cranial slope (CS) (Fig. 3) values were obtained at all of these follow-up times.

1. CL: Angle between the line parallel to the C2 posterior margin and the line parallel to the C7 posterior margin [3].
2. C2T: Angle between the vertical line passing through the center of C7 and a line passing through the center of the lower end plate of C2 and the center of C7 [8].
3. CS: Angle between the horizontal line and the McGregor line [8].

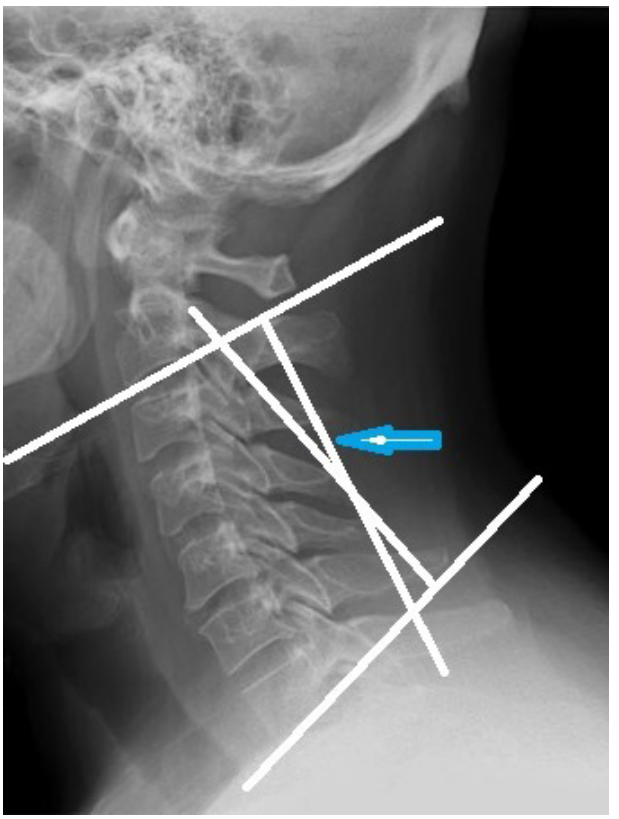

Figure-1. CL angle measurement by Cobb method.

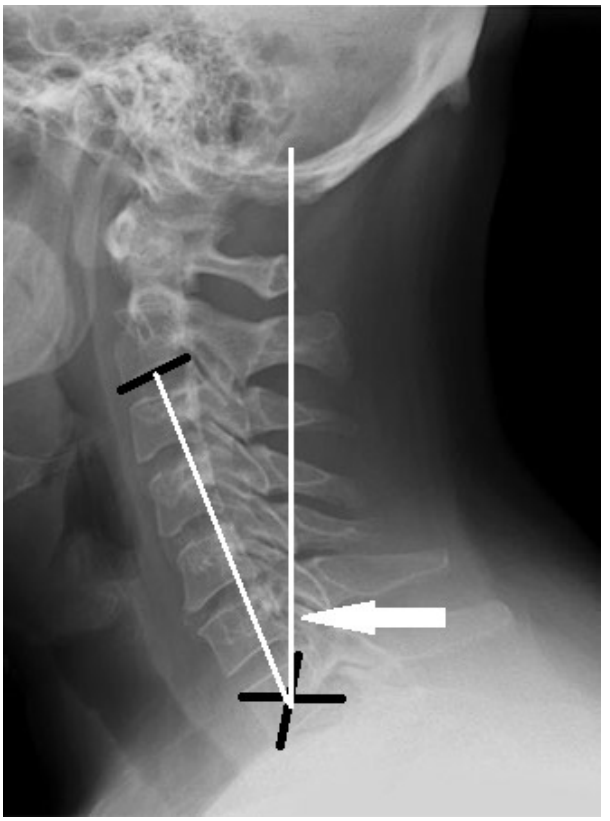

Figure-2. C2T angle measurement is shown.

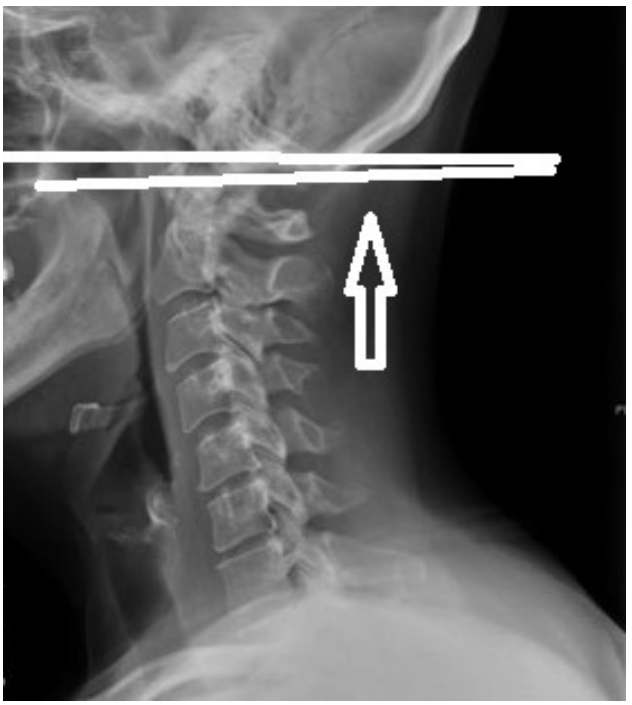

Figure-3. CS measurement.

Operation technique

ACDF is the treatment of choice for cervical disc herniation and spondylotic radiculopathy or myelopathy [9]. The patient is placed in the supine position with the neck slightly extended. The patient's head is fastened in the table with tape to maintain a neutral position, and his or her shoulders are tightened down with tape for allowing appropriate visualization with C-arm image intensifier. A right-side transverse 2 cm skin incision is done, platysma muscle is opened transversely. To reach to the anterior of the cervical vertebral column, dissection is advanced from the lateral edge of the M. sternocleidomastoid. Internal carotid artery and trachea-esophagus are retracted laterally and medially respectively. After fluoroscopic localizing, discectomy is performed by microinstruments under the operating microscope (Zeiss OpMi Pentera 900, 2012, Jena, Germany). After curettage of both endplates, a proper allograft (Demineralized Bone Matrix) filled PEEK cage (Polyether ether ketone Lor X® Cervical Peek cage with blade, TiGA14V ELI alloy, 0,3 mm tread depth, with 1,5 mm blades, 5º lordotic, static resistance of 15 kN/mm, dynamic strength of 100N / 1.000.000 cycles) inserted in the intervertebral space.

Statistical analysis

Changings of all parameters with time after operation were evaluated and compared with corresponding VAS scores. Descriptive statistics of whole data were analyzed. Normality assumptions of continuous variables were tested by Kolmogorov Smirnov test. Comparing changing of variables at follow-up times were tested by Friedman (post hoc: Bonferroni adjusted Wilcoxon test), Paired Samples t test and Wilcoxon tests. When the p values were less than 0.05, changing was accepted as statistically significant.

RESULTS

Patients' demographics

Thirty male (54.5%) and 25 female (45.5%) patients were included in the study. Mean age of the patients was 45.4 years old (27-67 years old).

Thirty-seven of the patients (67.2%) were operated for one level, 18 (32.7%) of them were operated for 2 levels CDH. The majority of the patients had an only one level CDH at the C5-6 level (41.8%). On the other hand, CDH at the C5-6 level was found in 70.9% of all patients (Table-1).

Table-1. CDH levels and frequency.

CDH levels	n	%
One level	37	67.3
C3-4	1	1.8
C5-6	23	41.8
C6-7	13	23.6
Two levels	18	32.7
C3-4 and C5-6	1	1.8
C3-4 and C6-7	1	1.8
C4-5 and C5-6	5	9.1
C4-5 and C6-7	1	1.8
C5-6 and C6-7	10	18.2
Total	55	99.9

Table-2. VAS scores and statistical results.

VAS scores	Mean±SD	Median	Min.	Max.	p
Preop.	6.76±1.07	7.00	5.00	9.00	< .001
Postop. 1st day	3.78±1.15	4.00	1.00	5.00	< .001
Postop. 15th day	2.62±1.35	3.00	.00	6.00	< .001
Postop. 3rd month	1.82±1.26	2.00	.00	5.00	< .001

Table-3. Changings and statistical results of radiographic measurements of sagittal parameters.

Sagittal parameter	Mean±SD	Median	Min.	Max.	p
CL preop.	8.9±6.6	6.7	.4	25.6	.285
CL postop.	9.8±8.3	7.2	-19.2	33.2	.285
C_2T preop.	12.9±4.9	11.2	2.9	22.1	.421
C_2T postop.	14.1±13.7	12.8	2.5	24.3	.421
CS preop.	9.7±5.6	8.3	1.0	23.7	.806
CS postop.	10.0±6.7	8.7	1.2	33.4	.806

All values are given as (°).

VAS scores

The VAS scores of the patient for preoperatively and all the follow-ups are shown in the Table-2. The mean VAS value is 7.0, 4.0, 3.0 and 2.0 preoperatively, on the 1st day, 15th day and 3rd month postoperatively respectively. Changing in time for VAS values is statistically significant for all the follow-up times (p<0.001 for each).

Radiographic measurements of sagittal parameters

Statistical analyses of changing of the sagittal parameters are given by the table 3. There is no statistically significant changing of sagittal radiologic measurements (Table-3). The maximum different values were used for postoperative values. These values were generally obtained on the postoperative 3rd month.

DISCUSSION

When the "pain" is considered as the main complaint, patients of the series of this study were improved after ACDF due to their postoperative VAS scores only, and changings of VAS grades. Decrease of the mean VAS score at the very early postoperative period, on the 1st day, is exceedingly impressive. The mean VAS score was 6.76 and 3.78 preoperatively and on the 1st day respectively. This result is statistically significant (p< .001). The importance of this result is that it indicates the main problem of patients with CDH. Extremely good recovery on the 1st postoperative day is the result of decompression of the neural tissue. Some studies in literature supports this idea [3,13]. Neural compression is the most crucial factor to develop symptomatology of CDH. It can be statistically claimed that ACDF operation is a very suitable choice of the treatment of the patients with 1 or 2 levels soft CDH according to mean VAS scores on the 15th day and 3rd month, 2.62 and 1.82 respectively. The p values are less than 0.001 on both follow-up periods. Continuing decrease of VAS scores at the postoperative period may be indicative of ongoing healing of the neural tissue after decompression.

Maximum recovery is seen very early postoperative period, but healing is continuing for a reasonable long time. When using median instead of mean as a statistical parameter, the condition doesn't change; p is less than 0.001 for every follow-up time. The median VAS decreased from 7.00 preoperatively, to 4.00, 3.00 and 2.00 postoperatively on the 1st, 15th days and 3rd month respectively. Location or multiplicity of the CDH doesn't make change VAS changings statistically. Changing is from preoperatively 7.0 to postoperatively 5.0 for C3-4 hernias; from 7.4 to 1.9 for C5-6 hernias; from 6.2 to 0.7 for C6-7 hernias and from 6.8 to 1.9 for two level hernias. Result of C3-4 hernia seems to anomalous outcome. But there is only one C3-4 CDH in the series, so its result is expected as statistically insignificant in all circumstances. Normal populations data about these parameters are given in the literature [4,8,16]. Normal values of CL, C2T and CS are 4.89°±12.84°, 10.48°±6.93° and 1.59°±6.81°.

The vital consequence of this study is that the results don't support the main hypothesis of the study which stated that the changings of the cervical sagittal parameters will be parallel to the recovery rate of patients. When the study designated, investigations of two main clinical predictions were considered. Is there any correlation between sagittal cervical parameters and symptomatology of CDH? And, can normalizing of sagittal parameters be provided after decompression of neural tissue via ACDF [6]? These two interdependent hypotheses are not confirmed by the result of this study.

Many factors may take place for happening of this result. A short follow-up time is a crucial weakness. Although it is not statistically significant, postoperative values of the radiographic measurements changed toward the values those of normal population's. This fact gives expectations about long term results. The second central fact which emerges these results that may be acknowledged of the CDDD develops in the disordered cervical sagittal profile. Preoperative sagittal measurements especially CL of some patients were within normal limits. Besides, despite well recovery due to their VAS values, some patient's sagittal parameters were getting worse after operation. It is widely accepted that cervical paravertebral muscle spasm is the reason of cervical spinal flattening [1]. And this spasm is an important component of the patient's pain [7]. The vital question is whether this paravertebral spasm is a structural phenomenon

or a reaction to degenerative changes. The certain way to understand this is to see the lateral cervical roentgenograms of patients with CDH before they become symptomatic! It is almost impossible practically! Since CS and C_2T are the parameters directly correlated with CL, all of these opinions are valid for CS and C_2T at the same time.

Another limitation of this study is that this is a retrospectively designated investigation. More circumstances can be controlled with a prospectively designated study.

That using a lordotic cage for all patients is one of a strong point of this study. It may be added a group of straight cage for a control to the study. This can measure the contribution of lordotic cage. But this is beyond of the scope of this study.

CONCLUSIONS

ACDF is a very beneficial choice for treatment of soft CDH. It is expected that cervical sagittal parameters normalize parallel to recovery of patients after ACDF operation. Some prospectively designated studies with long term results are required.

CONFLICT OF INTEREST

The authors of this manuscript declare that there is no financial or non-financial conflict of interest in the subject matter or materials discussed in this manuscript.

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